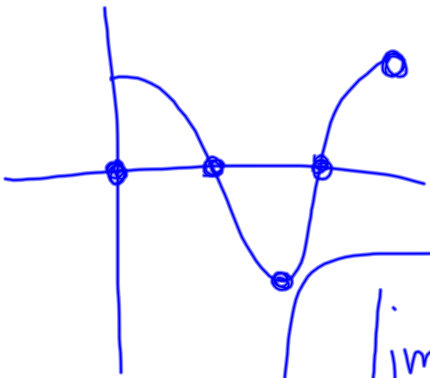
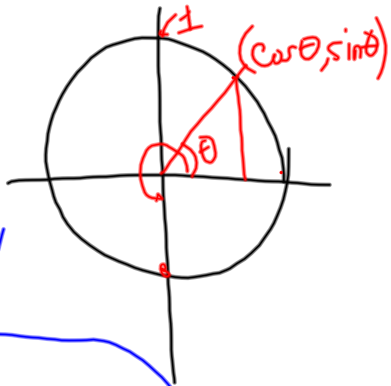
2.6/28

$$\lim_{x\to 0} \frac{x}{\cos\left(\frac{\pi}{2}-x\right)}$$

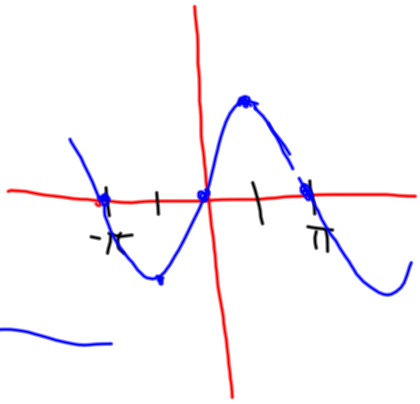
sin

x	$\frac{\pi}{2}-x$
$-\pi$	$\frac{3\pi}{2}$
$-\frac{\pi}{2}$	π
0	$\frac{\pi}{2}$
$\frac{\pi}{2}$	0
π	$-\frac{\pi}{2}$
$\vdots$	





$$\boxed{\lim_{x\to 0} \frac{x}{\sin x} = 1}$$



$$\cos(x \pm y) = \cos x \cos y \mp \sin x \sin y$$

$$\cos\left(\frac{\pi}{2}-x\right) = \cos\frac{\pi}{2}\cos x + \sin\frac{\pi}{2}\sin x$$

$$= 0 + (1)\sin x$$

$$\lim_{h\to 0}\frac{\sin h}{1-\cos h} = \lim_{h\to 0}\underbrace{\left(\frac{\sin h}{h}\right)}_{1}\underbrace{\left(\frac{h}{1-\cos h}\right)}_{\approx\text{"}\frac{1}{0}\text{"}}$$

$$= \text{DNE}$$

$$\lim_{x\to 0}\frac{\sin x}{x} = 1$$

$$\lim_{x\to 0}\frac{1-\cos x}{x} = 0$$

$$\lim_{h\to 0^+} \sim = +\infty$$

$$\lim_{h\to 0^-} \sim = -\infty$$

$$\lim_{h\to 0}\frac{\sin h}{1-\cos h}$$

$$\lim_{h\to 0} \frac{\sin h}{(1-\cos h)} \cdot \frac{(1+\cos h)}{(1+\cos h)} = \lim_{h\to 0} \frac{\sin h(1+\cos h)}{1-\cos^2 h}$$

$$= \lim_{h\to 0} \frac{\sin h \cdot (1+\cos h)}{\sin h \cdot \underline{\sin h}} \Rightarrow \text{DNE}$$

XX

$$\lim_{x\to 0} \frac{\sin^2 x}{3x^2} = \lim_{x\to 0} \left(\frac{1}{3}\right)\underbrace{\left(\frac{\sin x}{x}\right)}_{1}\underbrace{\left(\frac{\sin x}{x}\right)}_{1}$$

$$\frac{\text{VX}}{11}$$

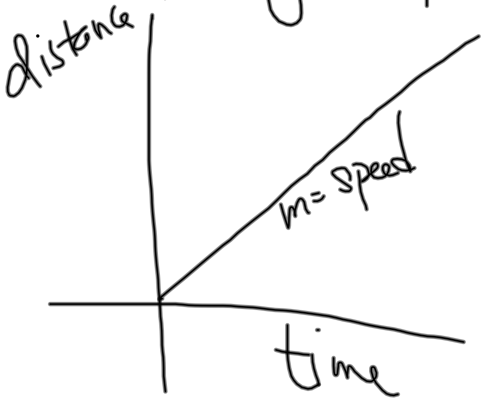
$$\lim_{t\to 0} \frac{t^2}{1-\cos^2 t}$$

$$= \lim_{t\to 0} \frac{t^2}{\sin^2 t} = \frac{1}{\lim_{t\to 0} \frac{\sin^2 t}{t^2}} = 1$$

Sep 19-7:26 AM

3.1) WHAT U KNO

$$\text{Average Speed} = \frac{|\text{change in distance}|}{\text{change in time}}$$



$$\text{average velocity} = \frac{\text{change in position}}{\text{change in time}}$$

velocity = speed, with a direction

Generalizing ....

given a function $f(x)$,

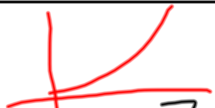
the average rate of change of $f(x)$ with respect to x between x_1 and x_2 $= \dfrac{f(x_2) - f(x_1)}{x_2 - x_1} = \dfrac{\Delta f(x)}{\Delta x}$

Instantaneous rate of change of $f(x)$ w.r.t. x at $x=a$ $= \lim_{x \to a} \dfrac{f(x)-f(a)}{x-a}$

wrt = with respect to

I.r.o.c. at $x=x_0$ $= \lim_{x_1 \to x_0} \dfrac{f(x_1)-f(x_0)}{x_1-x_0}$

$= \lim_{h \to 0} \dfrac{f(x_0+h)-f(x_0)}{h}$



Let $y = x^2+1$

a) find the average rate of chg of y wrt x over $[3,5]$.

$$= \frac{y(x=5) - y(x=3)}{5-3} = \frac{26-10}{2} = \frac{16}{2} = 8$$

b) find the instantaneous rate of chg of y wrt x at $x = -4$.

$$= \lim_{x\to a} \frac{f(x)-f(a)}{x-a} = \lim_{x\to -4} \frac{(x^2+1)-((-4)^2+1)}{x-(-4)} = \lim_{x\to -4} \frac{x^2-16}{x+4} =$$

$$= \lim_{x\to -4} \frac{(x-4)(x+4)}{(x+4)} \qquad \lim_{x\to -4} (x-4) = -8$$

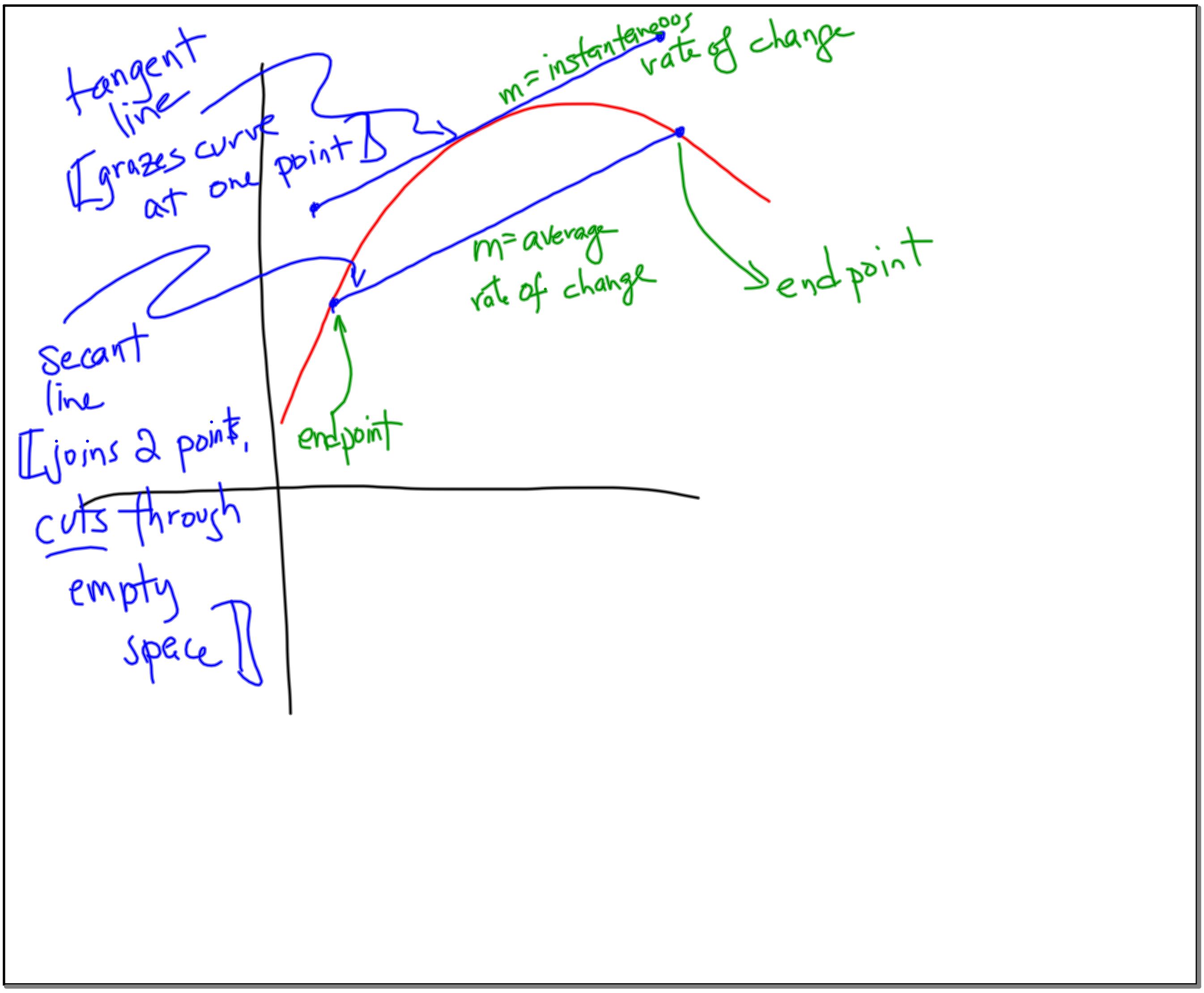
c) find 〃 〃 〃 〃 〃 〃 at $x = x_0$

$$\lim_{x\to x_0} \frac{f(x)-f(x_0)}{x-x_0} = \lim_{x\to x_0} \frac{(x^2+1)-(x_0^2+1)}{x-x_0}$$

$$= \lim_{x\to x_0} \frac{x^2-x_0^2}{x-x_0} = \lim_{x\to x_0} \left(\frac{(x-x_0)(x+x_0)}{(x-x_0)}\right)$$

$$= \lim_{x\to x_0} x+x_0 = x_0+x_0 = 2x_0$$

Sep 19-8:05 AM


tangent line
[[grazes curve at one point]]
m = instantaneous rate of change
m = average rate of change
endpoint
endpoint
secant line
[[joins 2 points, cuts through empty space]]

Sep 19-8:44 AM